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(54) FOREGROUND PICTURE EXTRACTING METHOD, PICTURE PROCESSOR, AUTOMATIC TRIMMING DEVICE, RECORDING MEDIUM AND PORTRAIT PICTURE DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide method/device for extracting a foreground picture by means of deleting a background from one picture, a device for automatically trimming the extracted picture, a recording medium stored with a program code for realizing them by a computer and a portrait picture device as a device synthesizing them.
SOLUTION: A difference between a background picture where only a background is previously photographed and an objective picture is obtained. The change quantity (difference) of brightness by the difference of both pictures at the time of photographing is corrected and therefore a mask picture is generated. An expansion/reduction processing is executed, a boundary between the area of the object and the area of the background is discriminated and the areas are divided. Thus, the mask picture of a man is generated and it is overapped with an objective picture so as to synthesize them. Thus, a man picture obtained by converting the background of the objective picture into a single color is generated. The vertex and the jaw of the man are retrieved from the person picture and a face picture is generated. Then, the
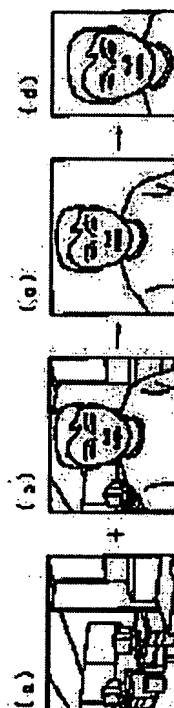
Notes:
1. Untranslatable words are replaced with asterisks (****).
2. Texts in the figures are not translated and shown as it is.

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[Claim(s)]

[Claim 1] In the foreground picture extraction method which extracts the subject currently photoed by the foreground in the picture of one sheet The step which photos the background image with which a subject does not exist, and the step which photos the object picture which located the subject in the foreground with the same frame as said background image, The step which computes the difference of the brightness in the predetermined common field of said object picture and said background image, The step which generates the 1st mask picture by asking for the difference of said background image and said object picture, and amending the difference of said brightness, The step which performs expansion / reduction processing of brightness to said 1st mask picture, The step which performs expansion / reduction processing of a color to the 1st mask picture to which expansion / reduction processing of said brightness was performed, The step which generates the 2nd mask picture by distinguishing the boundary line of the field of a subject, and the field of a background in the 1st mask picture to which expansion / reduction processing of said color was performed, and dividing a field in the boundary line, The foreground picture extraction method characterized by including the step which generates the picture which changed the background of said object picture into the single color by compounding said 2nd mask picture in piles in said object picture.

[Claim 2] In the Image Processing Division equipment which extracts the subject currently photoed by the foreground in the picture of one sheet A bias calculation means to compute the difference of the brightness in a predetermined common field with the object picture which the subject was located in the foreground and photoed with the same frame as the background image and this background image which photoed the state where a subject did not exist, A 1st mask picture generation means to generate the 1st mask picture by asking for the difference of said background image and said object picture, and amending the difference of said brightness, 1st expansion / reduction processing means which performs expansion / reduction

processing of brightness to the 1st mask picture which said 1st mask picture generation means generated, 2nd expansion / reduction processing means which performs expansion / reduction processing of a color to the 1st mask picture processed by said 1st expansion / reduction processing means, In the 1st mask picture processed by said 2nd expansion / reduction processing means, the boundary line of the field of a subject and the field of a background is distinguished. By compounding in piles a 2nd mask picture generation means to generate the 2nd mask picture by dividing a field in the boundary line, and the 2nd mask picture generated by said object picture by said 2nd mask picture generation means Image Processing Division equipment characterized by having a synthetic means to generate the picture which eliminated the background from said object picture.

[Claim 3] It has further a color system conversion means to perform the same color system conversion process to said background image and said object picture. Said 1st mask picture generation means is Image Processing Division equipment according to claim 2 characterized by having made that the 1st mask picture should be generated by making applicable to processing said background image from which the color system was changed by said color system conversion means, and said object picture.

[Claim 4] Said 1st and 2nd expansion / reduction processing means are Image Processing Division equipment according to claim 2 characterized by repeating expansion / reduction processing two or more times if needed.

[Claim 5] Image Processing Division equipment according to claim 2 characterized by having further a BOKASHI processing means to perform BOKASHI processing to the 2nd mask picture generated by said 2nd mask picture generation means.

[Claim 6] In the automatic trimming equipment which carries out trimming of the picture by which the person's upper half of the body was photoed on the background of a single color automatically so that a person's face may become within the limits of the outline line of predetermined size in a predetermined position A means to search a person's top of the head out of a picture, and a means to search flesh color near the lower part of the searched top of the head, A means to compute the searched beige average value, and a means to generate a face picture for the beige field of the predetermined range centering on beige average value as a person's face, Automatic trimming equipment characterized by having the center line of a face picture and a means to detect the inclination, a means to detect the jaw position in a face picture, and a means to determine the position of the face that a person's face will become within the limits of the outline line of said predetermined size in a predetermined position.

[Claim 7] It is the recording medium which recorded the computer program which makes a computer perform processing which extracts the subject currently photoed by the foreground in the picture of one sheet and in which computer reading is possible. A program code means in which computer reading is possible to make a computer compute the difference of the

brightness in a predetermined common field with the object picture which photoed the state where said subject was located in the foreground with the same frame as the background image and this background image which photoed the state where a subject did not exist, A program code means in which computer reading is possible to make a computer compute the difference of the brightness in the predetermined common field of said object picture and said background image, A program code means in which computer reading is possible and in which computer reading is possible to make a computer generate the 1st mask picture by asking for the difference of said background image and said object picture, and amending the difference of said brightness, A program code means in which computer reading is possible to make expansion / reduction processing of brightness perform to a computer to said 1st mask picture, A program code means in which computer reading is possible to make expansion / reduction processing of a color perform to a computer to the 1st mask picture to which expansion / reduction processing of said brightness was performed, In the 1st mask picture to which expansion / reduction processing of said color was performed, the boundary line of the field of a subject and the field of a background is distinguished. A program code means in which computer reading is possible to make a computer generate the 2nd mask picture by dividing a field in the boundary line, and by compounding said 2nd mask picture in piles in said object picture The recording medium which is characterized by recording the computer program including a program code means in which computer reading in which computer reading is possible is possible to make a computer generate the picture which changed the background of said object picture into the single color and in which computer reading is possible.

[Claim 8] In the photographic portrait equipment which generates the photographic portrait arranged so that a person's upper half of the body may come within the limits of the outline line of predetermined size on the background of a single color in a position predetermined in a person's face The camera which photos the background image and this background image with which a person does not exist, and the object picture which located the person's upper half of the body in the foreground with the same frame, A picture preservation means to save said background image beforehand photoed with this camera, A bias calculation means to compute the difference of the brightness in the predetermined common field of the background image saved for said picture preservation means, and the object picture photoed with said camera, A 1st mask picture generation means to generate the 1st mask picture by asking for the difference of said background image and said object picture, and amending the difference of said brightness, 1st expansion / reduction processing means which performs expansion / reduction processing of brightness to the 1st mask picture which said 1st mask picture generation means generated, In the 1st mask picture processed by 2nd expansion / reduction processing means which performs expansion / reduction processing of a color to the 1st mask picture processed by said 1st expansion / reduction processing means, and said 2nd

expansion / reduction processing means, the boundary line of the field of a subject and the field of a background is distinguished. By compounding in piles a 2nd mask picture generation means to generate the 2nd mask picture by dividing a field in the boundary line, and the 2nd mask picture generated by said object picture by said 2nd mask picture generation means A synthetic means to generate the portrait image which changed the background of said object picture into the single color, A means to search a person's top of the head out of said portrait image, and a means to search flesh color near the lower part of the searched top of the head, A means to compute the searched beige average value, and a means to generate a face picture for the beige field of the predetermined range centering on beige average value as a person's face, Photographic portrait equipment characterized by having the center line of a face picture and a means to detect the inclination, a means to detect the jaw position in a face picture, and a means to determine the position of the face that a person's face will become within the limits of the outline line of said predetermined size in a predetermined position.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] How to carry out trimming automatically so that it may be agreed on predetermined conditions, when this invention is [the Image Processing Division method especially the method of eliminating a background and extracting a foreground picture, and the extracted picture] a person's upper half of the body, It is related with the recording medium which recorded the computer program which the Image Processing Division equipment and the computer which perform such an Image Processing Division method are made to execute, and also the photographic portrait equipment as an example of utilization.
[0002]
[Description of the Prior Art] [a license, a passport, the photographic portrait for various certificates, the picture of the late him for funerals, and photography of the photographic portrait further for criminal investigations] conventionally A photograph of the range larger than the size as which it is originally demanded as a background becomes white or gray was taken, and it was judging according to the size of which the photograph which carried out trimming or, which was printed so that it might agree on the conditions as which the person's face is demanded is demanded.
[0003] by such a photography method of the conventional photographic portrait, it agrees on the conditions of which the photograph which a screen and suitable Lighting Sub-Division for exclusive use are required in order to acquire the background of white or gray, and was printed further is demanded -- as -- trimming -- or it needed to judge and had taken time and effort.

[0004] On the other hand, various Image Processing Division software is marketed with the improvement in performance and spread of personal computers in recent years. By the software of such marketing, it has the function which it extracts when a user specifies arbitrary fields, for example, a person's overview, a face, etc. out of [of one sheet] a picture, and can be compounded in other pictures, for example, scenery etc., in many cases. Therefore, although it is thought easy to create the above photographic portraits for certificates by using such a function Processing in which an arbitrary field is actually extracted from the picture of one sheet automatically is difficult. Also when a user needs to trace the boundary of a picture with pointing devices, such as a mouse, or all the self-** are stated, a certain amount of outline by a user's manual operation needs to be directed in practice in many cases.

[0005]

[Problem to be solved by the invention] Thus, in order to take a photographic portrait in the former, equipment (a screen, Lighting Sub-Division, etc.) for exclusive use is required. Moreover, trimming needed to be carried out, or the print needed to be cut out so that it might agree on the conditions demanded, and there were problems, like there is the necessity of photoing the range larger than the size demanded for that purpose.

[0006] Moreover, when using the Image Processing Division software, the actual condition is that the work which extracts a required field out of [of one sheet] a picture cannot but depend on a help, and quite advanced technology will be required for the user of a common personal computer.

[0007] The method of this invention being made in view of such a situation, eliminating a background from the picture of one sheet, and extracting a foreground picture, the equipment which carries out trimming of the picture equipment [the picture] and extracted automatically, Furthermore, it aims at offer of the photographic portrait equipment as the recording medium which recorded the program code for a computer to realize them, and equipment which unified them.

[0008]

[Means for solving problem] The step which photos the background image with which the foreground picture extraction method concerning this invention is a method of extracting the subject currently photoed by the foreground in the picture of one sheet, and a subject does not exist, The step which photos the object picture which located the subject in the foreground with the same frame as a background image, The step which computes the difference of the brightness in the predetermined common field of an object picture and a background image, The step which generates the 1st mask picture by asking for the difference of a background image and an object picture, and amending the difference of brightness, The step which performs expansion / reduction processing of brightness to the 1st mask picture, The step which performs expansion / reduction processing of a color to the 1st mask picture to which

expansion / reduction processing of brightness was performed, The step which generates the 2nd mask picture by distinguishing the boundary line of the field of a subject, and the field of a background in the 1st mask picture to which expansion / reduction processing of the color was performed, and dividing a field in the boundary line, By compounding the 2nd mask picture in piles in an object picture, it is characterized by including the step which generates the picture which changed the background of the object picture into the single color.

[0009] Moreover, the Image Processing Division equipment concerning this invention is equipment which extracts the subject currently photoed by the foreground in the picture of one sheet. A bias calculation means to compute the difference of the brightness in a predetermined common field with the object picture which the subject was located in the foreground and photoed with the same frame as the background image which photoed the state where a subject did not exist, and this background image, A 1st mask picture generation means to generate the 1st mask picture by asking for the difference of a background image and an object picture, and amending the difference of brightness, 1st expansion / reduction processing means which performs expansion / reduction processing of brightness to the 1st mask picture which the 1st mask picture generation means generated, 2nd expansion / reduction processing means which performs expansion / reduction processing of a color to the 1st mask picture processed by 1st expansion / reduction processing means, A 2nd mask picture generation means to generate the 2nd mask picture by distinguishing the boundary line of the field of a subject, and the field of a background in the 1st mask picture processed by 2nd expansion / reduction processing means, and dividing a field in the boundary line, By compounding in piles the 2nd mask picture generated by the object picture by the 2nd mask picture generation means, it is characterized by having a synthetic means to generate the picture which eliminated the background from the object picture.

[0010] [such a foreground picture extraction method and the Image Processing Division equipment of this invention] By photoing the object picture which located the subject in the foreground with the frame same when extracting the subject currently photoed by the foreground in the picture of one sheet as the background image and this in which a subject does not exist The difference of the brightness in the predetermined common field of both pictures is computed first, then the difference of a background image and an object picture is called for, the difference of brightness is amended further, and the 1st mask picture is generated. And expansion / reduction processing of brightness and expansion / reduction processing of a color are performed to this 1st mask picture, and the 2nd mask picture is generated by distinguishing the boundary line of the field of a subject, and the field of a background after that, and dividing a field in that boundary line. Finally, when the 2nd mask picture puts on an object picture and is compounded, the picture which changed the background of the object picture into the single color is generated.

[0011] Furthermore, the recording medium concerning this invention is a recording medium which recorded the computer program which makes a computer perform processing which extracts the subject currently photoed by the foreground in the picture of one sheet and in which computer reading is possible. A program code means in which computer reading is possible to make a computer compute the difference of the brightness in a predetermined common field with the object picture which photoed the state where the subject was located in the foreground with the same frame as the background image which photoed the state where a subject did not exist, and this background image, A program code means in which computer reading is possible to make a computer compute the difference of the brightness in the predetermined common field of an object picture and a background image, A program code means in which computer reading is possible and in which computer reading is possible to make a computer generate the 1st mask picture by asking for the difference of a background image and an object picture, and amending the difference of brightness, A program code means in which computer reading is possible to make expansion / reduction processing of brightness perform to a computer to the 1st mask picture, A program code means in which computer reading is possible to make expansion / reduction processing of a color perform to a computer to the 1st mask picture to which expansion / reduction processing of brightness was performed, In the 1st mask picture to which expansion / reduction processing of the color was performed, the boundary line of the field of a subject and the field of a background is distinguished. A program code means in which computer reading is possible to make a computer generate the 2nd mask picture by dividing a field in the boundary line, and by compounding the 2nd mask picture in piles in an object picture It is characterized by recording the computer program including a program code means in which computer reading in which computer reading is possible is possible to make a computer generate the picture which changed the background of the object picture into the single color.

[0012] Moreover, in the recording medium of above this inventions, the above-mentioned Image Processing Division equipment is realized by making a computer read the contents of record.

[0013] Moreover, the automatic trimming equipment concerning this invention is equipment which carries out trimming of the picture by which the person's upper half of the body was photoed on the background of a single color automatically so that a person's face may become within the limits of the outline line of predetermined size in a predetermined position. A means to search a person's top of the head out of a picture, and a means to search flesh color near the lower part of the searched top of the head, A means to compute the searched beige average value, and a means to generate a face picture for the beige field of the predetermined range centering on beige average value as a person's face, It is characterized by having the center line of a face picture and a means to detect the inclination, a means to detect the jaw

position in a face picture, and a means to determine the position of the face that a person's face will become within the limits of the outline line of predetermined size in a predetermined position.

[0014] [the automatic trimming equipment of such this invention] When carrying out trimming of the picture by which the person's upper half of the body was photoed on the background of a single color automatically so that a person's face may become within the limits of the outline line of predetermined size in a predetermined position A person's top of the head is searched out of a picture, flesh color is searched near [the] the lower part, the searched beige average value is computed, and a face picture is generated considering the beige field of the predetermined range centering on beige average value as a person's face. And the center line of a face picture and its inclination are detected, a jaw position is detected further, and the position of the face is determined that a person's face will become within the limits of the outline line of predetermined size in a predetermined position according to these detection results.

[0015] Furthermore, by the photographic portrait equipment concerning this invention combining above-mentioned Image Processing Division equipment and automatic trimming equipment, and limiting a subject to a person's upper half of the body It is characterized by generating the portrait image which changed the background of the object picture into the single color, and generating a photographic portrait automatically by determining the position of the face that a person's face will become within the limits of the outline line of further predetermined size in a predetermined position.

[0016] With such photographic portrait equipment, a photographic portrait is automatically generated from the picture photoed in the state where a person is in a foreground with the same frame as the background image and it which were photoed in the state where there is no person.

[0017] In addition, in a foreground picture extraction method, Image Processing Division equipment, an above-mentioned recording medium, and above-mentioned photographic portrait equipment, a background image may be photoed beforehand and may be saved. This should just photo one background image first.

[0018] Moreover, in a foreground picture extraction method, Image Processing Division equipment, an above-mentioned recording medium, and above-mentioned photographic portrait equipment, after performing the same color system conversion process to a background image and an object picture, you may generate the 1st mask picture. More effective processing is attained by this processing by color systems other than the color system at the time of a picture being photoed first.

[0019] Moreover, in a foreground picture extraction method, Image Processing Division equipment, an above-mentioned recording medium, and above-mentioned photographic

portrait equipment, you may repeat 1st and 2nd expansion / reduction processings two or more times if needed. Thereby, the state of a picture required for the next processing can fully be acquired.

[0020] Moreover, in above-mentioned automatic trimming equipment and photographic portrait equipment, you may perform BOKASHI processing to the 2nd mask picture. When this finally compounds a picture, it is prevented that the outline of a subject becomes unnatural.

[0021]

[Mode for carrying out the invention] This invention is hereafter explained in full detail based on the Drawings in which the form of the operation is shown.

[0022] The outline of the procedure of foreground picture extraction of this invention and the procedure of automatic trimming is first explained with reference to the mimetic diagram of a picture showing the procedure shown in drawing 1 . The procedure of the outline of the foreground picture extraction method of this invention is as the following. First, the background image is beforehand photoed as shown in drawing 1 (a). And drawing 1 (b) A photograph is taken by making a person into a foreground with the same frame as the background image currently photoed beforehand as shown. If it puts in another way, the camera itself will perform what is called fixed point photography to which the position and the view were fixed. And it is drawing 1 (c) by extracting difference from both. Only the picture of the person who is a foreground is automatically extracted as shown. Trimming of a person's picture extracted by the above foreground picture extraction methods, especially the picture of a face is automatically carried out so that it may agree on the conditions beforehand demanded as finally shown in drawing 1 (d).

[0023] By performing automatically the procedure shown in each mimetic diagram of the above drawing 1 , the equipment which creates the photographic portrait of a proof photograph etc. automatically is realized. Moreover, drawing 1 (a) Or drawing 1 (c) By performing the procedure shown automatically, Image Processing Division software which extracts automatically the field (specific photographic subject) for which not only a person but a user asks out of arbitrary pictures is realized.

[0024] The following and drawing 1 (a) And drawing 1 (b) The picture of two sheets as shown in the mimetic diagram to drawing 1 (c) The foreground picture extraction method which obtains the picture of the state by which it is shown in the mimetic diagram is explained in full detail. In addition, in the following explanation, it is drawing 1 (a). Drawing 1 (b) from which the picture of only the background which is shown in the mimetic diagram, and which is photoed beforehand is called background image, and the person is photoed by the foreground with the same frame as this background image A picture as shown is called object picture. Moreover, these background images and an object picture should just be prepared in the state which can be processed as digital data.

[0025] The bias of a background portion is measured first. [this] when the time of a background image being photoed and an object picture are photoed Even if the brightness of a background is not necessarily the same at all and photos a background image and an object picture at intervals of several seconds, it is because it is not avoided that the brightness of a background changes delicately when a person goes into a foreground. Therefore, when the difference of a background image and an object picture is taken simply, the whole object picture will be extracted. In order to avoid such a situation, the field (henceforth a standard field) used as a standard is set as the portion in an object picture by which the background is always photoed. When the purpose which photos an object picture is a person's photographic portrait, it is drawing 2 (b). A background is certainly photoed by the both sides of the upper end of the frame of a picture, and the concrete target on both the outsides of a person's head as shown in the mimetic diagram. For this reason, drawing 2 (a) And drawing 2 (b) The standard field is beforehand set up as shown by the reference mark R.

[0026] It is B (RB), when the standard field of RB and an object picture is set to RO for the standard field of a background image and each brightness is set to B (RB) and B (RO) here. As for = B(RO)+Bi, however Bi, a bias value is materialized. In addition, the bias value Bi is detected as difference of brightness on both the pictures photoed although it was the amount of change of the brightness of both the pictures at the photography time.

[0027] Next, a mask picture (1st mask picture) is obtained by taking the difference of a background image and an object picture as shown in each mimetic diagram of drawing 3 , but a color system is changed if needed in this case. [take / with a scanner / a film or a print] when processing a picture by computer A direct entry is carried out from a digital camera (a still or movie), it reads from a recording medium (various disk media, a RAM card, etc.), or storing beforehand etc. needs to be operated for fixity memory means (hard disk etc.). make it any -- the time of processing a picture by computer other, although a RGB color system is used in many cases -- for example -- When it changes into a YIQ color system, a HSI color system, and a XYZ color system, sensitivity may improve to specific vectors, such as hue and luminosity. In therefore, the case so that the difference of a background image and an object picture may not be so large in a RGB color system case [for example,] a background image is near beige -- case a person's clothes are close to the color of a background -- RGB a system -- [whether both difference is taken after changing into the color system of above-mentioned either of except] Moreover, it is desirable to perform processing which crawls, changes into the color system of shoes, takes difference in each, and judges those results synthetically.

[0028] thus -- Drawing 3 (a) after changing into the color system of RGB color system remaining as it is or others The background image and drawing 3 (b) which are shown by taking difference with the object picture shown and amending the further above-mentioned bias value Bi Drawing 3 (c) from which only the field of the foreground (in this case, person)

was extracted A mask picture (the 1st mask picture) as shown in the mimetic diagram is obtained. However, drawing 3 (c) When a background has change as shown in both the side side of the portion equivalent to a person's head, a possibility that the portion may be extracted on a mask picture, and a noise will mix is also possible.

[0029] Next, as shown in each mimetic diagram of drawing 4 Drawing 4 (a) It is drawing 4 (b) to a mask picture. It is expansion processing and drawing 4 (c) of brightness as shown. The portion equivalent to the person in a picture is smoothed by performing reduction processing (maximum and minimum of brightness) of brightness as shown. By adding such processing, it becomes possible to judge the hair etc. as some persons, for example, and to identify, also when clothes are the colors of a background and a same system.

[0030] Furthermore, while eliminating the noise and the change portion of a background which may exist in a background portion by filling the whole field surrounding the portion equivalent to a person to the mask picture obtained by having repeated expansion and reduction as mentioned above It is possible to bury the deficit portion which may have been produced inside the portion equivalent to a person.

[0031] Specifically, it is drawing 5 (a). Since the noise and the change portion of the background may be contained in the mask picture as shown, Although it is not perfect by repeating expansion / reduction processing of a color, a certain amount of guarantee comes to be given, and it is drawing 5 (b). And (c) Distinction of the boundary line of the portion and background which a person deserves as shown is attained. And it is drawing 5 (d) by finally separating a field by the boundary line of a background and the portion equivalent to a person. The mask picture (2nd mask picture) of a person as shown is obtained.

[0032] Next, drawing 6 obtained as mentioned above (a) It is a gauss (Gauss) about a person's mask picture. By processing BOKASHI etc., it is drawing 6 (b). It is carried out smoothly as shown.

[0033] To the last, it is drawing 7 (a). An object picture (the same as that of the object picture of drawing 1 (b)), and drawing 7 (b) It is drawing 7 (c) about a person's mask picture in composition, for example, the thing alpha composition of is done. A non-background [like] and the portrait image which is more specifically a single color background are obtained. Specifically, both pictures are compounded by processing value"1" of a mask for value"0" of a mask as a person in a background color. In addition, when not performing BOKASHI processing shown in above-mentioned drawing 6 , it is drawing 7 (a). An object picture and drawing 7 (b) The boundary line at the time of compounding a person's mask picture will become sharp too much, and an unnatural picture will be obtained.

[0034] By the above, it is drawing 1 (a). A background image and drawing 1 (b) An object picture to drawing 7 (c) The portrait image of a non-background is obtained automatically. However, since it does not agree in conditions, a position [specifically as opposed to the size

and outline of the outline size of a photograph, and a face], etc. which are defined with various proof photographs in the state of this as, it is drawing 8 (a). It is drawing 8 (b) about the state of a mimetic diagram. It is necessary to change trimming into the state of a mimetic diagram. The procedure of such automatic trimming is explained hereafter.

[0035] First, a person's top of the head is detected and the portion of the color (beige) it can be considered that is the face focusing on it is detected. Specifically, it is drawing 9 (a). Drawing 9 (b) of the portrait image of a single color background The top of the head is detected by searching an outline [like] from an upper end. furthermore -- in the lower part -- for example, -- searching in the comparatively large range from the red in a HIS color system to yellow -- drawing 9 (c) The color of skin is searched as shown.

[0036] Since it can consider that the portion corresponding to the color of this skin is a part for regions of face, that average value is calculated, it considers that the portion of the range of a certain amount of color as a center is the face for the calculated average value, and a mask is created. Specifically, it is drawing 10 (a). It asks for the average of the color of skin from the picture which acquired the portion which corresponds beige as shown, and the search range is made large (it is about a threshold) for the search range about a bright portion narrowly (it is about a threshold) in consideration of searching the position of a jaw about a dark portion. As a result, drawing 10 (b) The picture (henceforth a face mask picture) of only a face as shown is obtained.

[0037] Next, from a face mask picture, the center of gravity of the face is searched for and the picture of only the closed region including the center of gravity is created. Specifically, it is drawing 11 (a). A face mask picture to drawing 11 (b) The picture of only a closed region as shown is created and it is drawing 11 (c). as shown It slices in the direction (it is a horizontal direction on a picture) of X, the center of gravity of the direction of the X-axis in Y coordinates each for regions of face is searched for, and it is drawing 11 (d). It asks for X coordinate value of the center of the face, and inclination from the arrangement of each center of gravity searched for as shown. In addition, drawing 11 (c) It considers that the lowermost part of a closed region is the position of a jaw, and it is detected as shown.

[0038] Since the size (making a jaw into a minimum position by making the top of the head into a maximum position) of the up-and-down direction of the face, a main axis, and inclination become clear by the above as shown in drawing 12 (b) Drawing 12 (a) The case of the predetermined outline size of a photograph as shown, for example, the photograph for passports, determines expansion and reduction of a portrait image, and the arrangement to an outline according to the position of 3.5cm x4.5cm and the top of the head, and a jaw, and performs trimming. Thereby, it is drawing 12 (c). The proof photograph with which the face has been arranged is generated by the predetermined position in predetermined outline size as shown.

[0039] Thus, drawing 1 (a) by photoing the background image as shown beforehand Drawing 1 (b) which carried out fixed point photography for the same background as it The picture of a person as shown to drawing 7 (c) The portrait image of the person of a non-background as shown is obtained automatically, and it is drawing 12 (c) further. The proof photograph corresponding to predetermined conditions as shown is acquired.

[0040] Next, the Image Processing Division equipment for enforcing the above this invention methods is explained. Drawing 13 is the functional block diagram showing the example of composition of the Image Processing Division equipment for enforcing a foreground picture extraction method.

[0041] A camera 11 is drawing 1 (a) which was used in order to photo a background image and an object picture, and was photoed. To the background image memory part 12, a background image as shown is drawing 1 (b). An object picture as shown is memorized by the object picture memory part 13, respectively. in addition, the picture (a background image and object picture) photoed with the camera 11 -- usually -- It is a RGB color system.

[0042] In addition, as for both the memory parts 12 and 13, it is needless to say that one memory storage may be used as hardware. Moreover, although it is necessary to photo a background image beforehand and to make the background image memory part 12 memorize, you may make it crowded [an object picture / direct picking] from a camera 11 each time.

[0043] It is inputted into the bias calculation part 14, and the data of both pictures is drawing 2 (a). And (b) The bias value Bi is computed from brightness [of the standard field RB of a background image, and the standard field RO of an object picture] B (RB), and B (RO) as shown. The bias value Bi computed in this bias calculation part 14 is given to the mask picture generation part 16 mentioned later.

[0044] On the other hand, the data of both pictures is inputted also into the color system conversion part 15. This color system conversion part 15 performs the same color system conversion process to the both sides of a background image and an object picture. for example, the picture photoed with a camera 11 as mentioned above -- general -- other [in a background image and an object picture] in the color system conversion part 15, although it is a RGB color system -- for example -- It changes into a YIQ color system, a HSI color system, a XYZ color system, etc. Thereby, the sensitivity to specific vectors, such as hue in the case of the difference extraction processing performed in the mask picture generation part 16 next and luminosity, is raised.

[0045] In the color system conversion part 15 above-mentioned in the mask picture generation part 16 The difference of the background image changed into one of other color systems and an object picture is extracted from a RGB color system. Furthermore, by amending the bias value Bi currently previously computed in the bias calculation part 14, it is drawing 3 (c). A mask picture as shown is generated.

[0046] In in addition, the case so that the difference of a background image and an object picture may not be so large in a RGB color system For example, when a background image is near beige, and a person's clothes are close to the color of a background, it is. [take / after changing both a background image and an object picture into above-mentioned ones other than a RGB color system of color systems in the color system conversion part 15 / both difference] Moreover, it is desirable to perform processing which takes difference as yes, change into the color system of shoes and be alike, respectively, and judges those results synthetically. Although it has the above-mentioned color system conversion part 15 from such a situation, it cannot be overemphasized that processing by the mask picture generation part 16 may be performed as it is by the color system (generally RGB color system) at the time of a photograph being first taken with a camera 11 without performing the conversion process of a color system.

[0047] Drawing 3 (c) generated by the mask picture generation part 16 Next, it is given to expansion / reduction processing part 17 by the mask picture as shown, and Drawing 4 (a), (b), The portion equivalent to the person in a picture is ********(ed) by performing expansion processing of brightness and reduction processing (maximum and minimum of brightness) as shown in (c). As a result, drawing 5 (a) A mask picture as shown is generated.

[0048] It is given to the person mask picture generation part 18 by the mask picture to which expansion / reduction processing in expansion / reduction processing part 17 was performed, and Furthermore, drawing 5 (a), (b), (c) By performing expansion processing of a color and reduction processing as shown, field division of the boundary line of the portion of the person in a picture and the portion of a background is detected and carried out, and it is drawing 5 (d). A person mask picture as shown is generated.

[0049] The person mask picture generated in this person mask picture generation part 18 is drawing 6 (b) which it was given to the BOKASHI processing part 19 next, for example, processing of gauss BOKASHI etc. was performed, and was carried out smoothly. A person mask picture as shown is obtained.

[0050] The person mask picture obtained in the BOKASHI processing part 19 is given to the synthetic part 20 next. this synthetic part 20 -- drawing 1 (b) the data of the object picture shown is also given from the object picture memory part 13 -- this object picture and drawing 6 (b) a person's mask picture generated in the BOKASHI processing part 19 shown -- composition -- for example, alpha composition of is done. As a result, it is drawing 7 (c) as an output of the synthetic part 20. The portrait image of a non-background (single color background) as shown is obtained as a synthetic result.

[0051] Specifically, processing in the synthetic part 20 compounds both pictures by processing value"1" of a mask for value"0" of a mask as a person in a background color. In addition, in not performing BOKASHI processing by the above-mentioned BOKASHI processing part 19, the

boundary line at the time of compounding an object picture and a person's mask picture becomes sharp too much, and becomes a little unnatural picture. However, since this is not an essential problem, it cannot be overemphasized that the BOKASHI processing by the BOKASHI processing part 19 may be omitted.

[0052] A background image and drawing 1 (b) as shown in drawing 1 (a) by the Image Processing Division equipment of composition as shown in drawing 13 as mentioned above An object picture as shown to drawing 7 (c) The portrait image of the non-background [as] shown is obtained automatically.

[0053] Next, the automatic trimming equipment of this invention is explained with reference to the functional block diagram of drawing 14 showing the example of composition.

[0054] [the portrait image memory part 31 / the portrait image of the non-background generated by the above-mentioned synthetic part 20] Moreover, the conditions (in the case of for example, the proof photograph for passports, in 3.5cm x4.5cm, the outline size of from the upper side to the top of the head is [from the lower side to a jaw] 11**2mm at 7**2mm) of the photograph which should be generated are beforehand memorized by the photograph condition memory part 32.

[0055] The data of the portrait image memorized by the portrait image memory part 31 is given to the top-of-the-head search part 33, and the top of the head is searched. Processing in this top-of-the-head search part 33 is scanned in the direction of X from the upper end of a portrait image in a lower part, and, specifically, is performed by calculating Y coordinate value in which a different color from the color of the single color background compounded in the synthetic part 20 exists.

[0056] thus -- centering on the position of the top of the head by the beige search part 34 next, if the top of the head is found -- for example, -- In a HIS color system, the color it can be considered that is the face is searched flesh color and by more specifically searching in the comparatively large range from red to yellow.

[0057] In the following face picture generation part 35, since it can be considered that the beige portion searched by the beige search part 34 is a part for regions of face, the average value is calculated, and it considers that the portion of the range of a certain amount of color as a center is the face for the calculated average value, and creates a mask.

[0058] The face picture generation part 35 asks for the average of the color of the skin which the beige search part 34 searched, and, specifically, makes the search range large (it is about a threshold) for the search range about a bright portion narrowly (it is about a threshold) in consideration of searching the position of a jaw about a dark portion. As a result, drawing 10 (b) The picture (henceforth a face mask picture) of only the face as shown is obtained.

[0059] Next, from the face mask picture generated by the face picture generation part 35, a face center and the inclination primary detecting element 36 search for the center of gravity of

the face, and creates the picture of only the closed region including the center of gravity. Specifically, a face center and the inclination primary detecting element 36 are drawing 11 (a) which the face picture generation part 35 generated. A face mask picture as shown to drawing 11 (b) The picture of only a closed region as shown is created. Drawing 11 (c) It slices in the direction (it is a horizontal direction on a picture) of X, the center of gravity of the direction of the X-axis in Y coordinates each for regions of face is searched for, and it is drawing 11 (d) as shown. It asks for X coordinate value of the center of the face, and inclination from the arrangement of each center of gravity searched for as shown.

[0060] Next, the jaw position primary detecting element 37 is drawing 11 (c). It considers that the lowermost part of a closed region is the position of a jaw, and it is detected as shown.

[0061] Since the size (making a jaw into a minimum position by making the top of the head into a maximum position) of the up-and-down direction of the face, a main axis, and inclination become clear by the above, those data is given to the photographic portrait generation part 38. Moreover, in addition to this, photograph conditions are given to the photographic portrait generation part 38 for the data of a portrait image from the photograph condition memory part 32 from the portrait image memory part 31, respectively. The photographic portrait generation part 38 amends inclination while determining the position of an outline that it expands or reduces to the data of the portrait image given from the portrait image memory part 31 so that the top of the head and a jaw may serve as a predetermined position to the outline of a photograph, respectively, and a person's face is located in the center of a photograph.

[0062] By the above, it is drawing 8 (a). The portrait image of the person of a non-background as shown to drawing 12 (c) The proof photograph corresponding to predetermined conditions as shown is generated.

[0063] In addition, although it has the portrait image memory part 31 for memorizing the data of the portrait image for processing with the Image Processing Division equipment of composition of being shown in above-mentioned drawing 14, you may carry out the direct entry of the data of the portrait image outputted from the synthetic part 20 shown in drawing 13 to the top-of-the-head search part 33. In this case, the photographic portrait equipment with which the automatic trimming equipment shown in the Image Processing Division equipment and drawing 14 for enforcing the foreground picture extraction method shown in drawing 13 was unified is realized.

[0064] By the way, although each Image Processing Division equipment shown in above-mentioned drawing 13 and above-mentioned drawing 14 consists of memory storage MU1, MU2, and arithmetic unit PU1 and PU2 It is also possible to also constitute these as hardware for exclusive use and to use arithmetic unit PU1 and an arithmetic unit general-purpose as PU2, i.e., a personal computer, and to realize each function by software, although it is possible, of course. In that case, two above pieces of the equipment [with one personal

computer] It is realizable what is made for a personal computer to read one computer program more specifically recorded on recording media (a flexible disk, CD-ROM, etc.) (it installs).

[0065] Drawing 15 is the mimetic diagram showing the appearance of such a personal computer 50. [this personal computer 50] [above Image Processing Division] the flexible disk FD or CD-ROM CD with which the computer program PG for carrying out was recorded from -- the contents of record (program code) Flexible disk drive (FDD) 61 for reading And CD-ROM drive (CDD) 62 ****************. moreover -- the reference mark 63 shows the hard disk as a fixity memory means -- an above-mentioned flexible disk FD or above-mentioned CD-ROM CD from -- each program code of the read computer program PG is memorized.

[0066] In addition, the reference mark 55 is as a display means. The reference marks 52 and 53 show the keyboard and mouse as an input means and a pointing device for the CRT display, respectively. However, a flexible disk FD and CD-ROM CD It cannot be overemphasized that the various recording media of an except may be used.

[0067] Drawing 16 is the block diagram showing the example of an internal configuration of a personal computer 50, and is CPU51. It is considered as a center and is above-mentioned FDD61, CDD62, and HDD63 by Bath 60, The CRT display 55 grade is connected. Moreover, a camera 11, a keyboard 52, and a mouse 53 are interfaces (I/O) 54. It minds and connects with Bath 60. In addition, the reference marks 56 and 57 show RAM as a model, and ROM, respectively.

[0068] By the flexible disk drive 61, [flexible disk / FD] or CD-ROM drive 62 -- CD-ROM CD from -- [a code / the program code of the read computer program PG is once memorized by the hard disk 63, and] It is RAM56 when the program code of a computer program PG is executed. It transmits and memorizes.

[0069] In addition, as a recording medium, they are a flexible disk FD and/or CD-ROM CD here. Although shown, it is not restricted to these, and it is a proper drive. (reading means) By combining, it is magnetic tape, Of course, use of a magneto-optical disc etc. is also possible.

[0070] Drawing 17 is the mimetic diagram showing the contents of the computer program PG currently recorded on the flexible disk FD as an example of a recording medium.

[0071] [the flexible disk FD shown in drawing 17] Program code which computes the bias value Bi of a background image and an object picture (PC11), Program code which performs the same color system conversion process to a background image and an object picture (PC12), it asks for the difference of the background image after color system conversion, and an object picture. The program code which amends the bias value Bi and raw-** a mask picture (PC13), The program code which performs expansion / reduction processing of brightness to a mask picture (PC14), The program code which divides a field by the boundary line of a person's field and the field of a background, and generates a person mask picture (PC15), Program code which carries out BOKASHI processing of the person mask picture

(PC16), the program code which compounds a person mask picture and an object picture and generates a portrait image (PC17), The program code which searches a person's top of the head out of a portrait image (PC21), The program code which searches flesh color near the lower part of the searched top of the head (PC22), The program code which computes the searched beige average value (PC23), The program code which generates a face picture for the beige field of the predetermined range centering on beige average value as a person's face (PC24), The center line of a face picture, and program code which detects the inclination (PC25), Program code which detects a jaw position from a face picture (PC26), The program code (PC27) which generates a photographic portrait according to photograph conditions is recorded.

[0072] The recording medium with which such a program code was recorded, for example, CD-ROM CD, CDD62 When inserted in, each program code currently recorded on it is once memorized by HDD63. and -- accepting necessity -- HDD63 from -- each program code is read -- RAM56 memorizing -- each -- CPU51 Sequential execution is carried out. the personal computer 50 in that case -- if it puts in another way, operation of the photographic portrait equipment of this invention comes to be shown in the flow chart of drawing 18.

[0073] However, a photograph is beforehand taken with a camera 11, and a background image is HDD63. It shall be stored, an object picture is photoed with a camera 11, and it is HDD63 beforehand. It shall be stored or a photograph shall not yet be taken. Furthermore, the photograph conditions corresponding to various kinds of proof photographs for passports, for example, an object, the object for licenses, etc. are HDD63 beforehand. It shall be stored.

[0074] An object picture is HDD63. An operator is HDD63 when already stored. A keyboard 52 or a mouse 53 is operated and it is directed any of some photographs stored are processed. On the other hand, when the photograph of the object picture is not yet taken, where a person is located in a proper position, an operator operates a camera 11, and an object picture is photoed. In this case, it is once data of a camera 11 to a photograph HDD63 of a personal computer 50 It may be made to transmit and memorize, and it may read from a camera 11 directly and you may process.

[0075] next -- if an operator gives directions of a processing start by operation of a keyboard 52 or a mouse 53 -- CPU51 first -- a background image -- HDD63 from -- it reads and an object picture is directly read from HDD63 or a camera 11 (Step S10) . And CPU51 The bias value Bi of both pictures is computed. (Step S11) . Next, CPU51 The same color system conversion process is performed to a background image and an object picture. (Step S12) It asks for the difference of the background image after the color system conversion, and an object picture, and a mask picture is generated by amending the bias value Bi further. (Step S13) . Next, CPU51 Expansion / reduction processing of brightness is performed to a mask picture. (Step S14) Expansion / reduction processing of a color is performed further. (Step S15) . These

expansion / reduction processings are repeated two or more times if needed.

[0076] And CPU51 The boundary line of a person's field and the field of a background is distinguished from the mask picture which repeated expansion and reduction of proper number-of-times brightness, and a person mask picture is generated by dividing a field in the boundary line. (Step S16) . Gauss BOKASHI etc. processes this person mask picture next. (Step S17) Although it is given and is obscured suitably, you may omit depending on the case. CPU51 [next,] HDD63 from -- the portrait image of a non-background (a background color is white or gray) is generated by compounding the person mask picture after reading the object picture again and performing above-mentioned BOKASHI processing to this object picture in piles (Step S18) .

[0077] Next, CPU51 A person's top of the head is searched out of the portrait image generated as mentioned above (Step S19), and flesh color is searched near the lower part of the searched top of the head. (Step S20) The searched beige average value is computed. (Step S21) . And CPU51 A face picture is generated for the beige field of the predetermined range centering on beige average value as a person's face. (Step S22) The center line of a face picture and its inclination are detected. (Step S23) A jaw position is further detected from a face picture. (Step S24) . the last -- CPU51 HDD63 from -- an operator reads the conditions of the photograph set up beforehand (Step S25) A photographic portrait is generated according to the photograph condition. (Step S26) .

[0078] The photograph which agreed by the above on the conditions the photograph specified by an operator, for example, for the proof photographs of a passport, is generated automatically.

[0079]

[Effect of the Invention] As explained in full detail above, according to the foreground picture extraction method and the Image Processing Division equipment of this invention, it becomes possible easily to extract the person currently photoed by the foreground, an object, etc. from a background image as a picture of a non-background (single color background).

[0080] Moreover, according to the automatic trimming equipment of this invention, it becomes possible to carry out trimming automatically so that the face of the picture of the person of a non-background (single color background) may be arranged in a predetermined outline size at a predetermined position.

[0081] Moreover, according to the recording medium of this invention, it becomes possible to realize the above equipment easily by making a personal computer read the program code which is the contents of record.

[0082] Furthermore, by photoing the background image beforehand according to the photographic portrait equipment of this invention Without preparing the screen and a special proof of white or gray, the picture of the upper half of the body of the person of a non-

background (single color background) is generated, and it enables the face to create further easily the photograph arranged in a predetermined outline size in the predetermined position, i.e., a proof photograph.

[Brief Description of the Drawings]

[Drawing 1] It is a mimetic diagram for explaining the outline of the procedure of foreground picture extraction of this invention, and automatic trimming.

[Drawing 2] It is a mimetic diagram for explaining the procedure of the foreground picture extraction method of this invention.

[Drawing 3] It is a mimetic diagram for explaining the procedure of the foreground picture extraction method of this invention.

[Drawing 4] It is a mimetic diagram for explaining the procedure of the foreground picture extraction method of this invention.

[Drawing 5] It is a mimetic diagram for explaining the procedure of the foreground picture extraction method of this invention.

[Drawing 6] It is a mimetic diagram for explaining the procedure of the foreground picture extraction method of this invention.

[Drawing 7] It is a mimetic diagram for explaining the procedure of the foreground picture extraction method of this invention.

[Drawing 8] It is a mimetic diagram for explaining the procedure of the automatic trimming of this invention.

[Drawing 9] It is a mimetic diagram for explaining the procedure of the automatic trimming of this invention.

[Drawing 10] It is a mimetic diagram for explaining the procedure of the automatic trimming of this invention.

[Drawing 11] It is a mimetic diagram for explaining the procedure of the automatic trimming of this invention.

[Drawing 12] It is a mimetic diagram for explaining the procedure of the automatic trimming of this invention.

[Drawing 13] It is the functional block diagram showing the example of composition of the Image Processing Division equipment of this invention.

[Drawing 14] It is the functional block diagram showing the example of composition of the automatic trimming equipment of this invention.

[Drawing 15] It is the mimetic diagram showing the appearance of the personal computer with which the recording medium of this invention is installed.

[Drawing 16] It is the block diagram showing the example of an internal configuration of the personal computer with which the recording medium of this invention is installed.

[Drawing 17] It is the mimetic diagram showing the contents of the computer program currently recorded on the recording medium of this invention.

[Drawing 18] It is the flow chart which shows the procedure of the personal computer as photographic portrait equipment of this invention of operation.

[Explanations of letters or numerals]

FD Flexible disk

CD CD-ROM

PG Program

PC11-PC17, PC21-PC27 Program code

11 Camera

12 Background Image Memory Part

13 Object Picture Memory Part

14 Bias Calculation Part

15 Color System Conversion Part

16 Mask Picture Generation Part

17 Expansion / Reduction Processing Part

18 Person Mask Picture Generation Part

19 BOKASHI Processing Part

20 Synthetic Part

31 Portrait Image Memory Part

32 Photograph Condition Memory Part

33 Top-of-the-Head Search Part

34 Beige Search Part

35 Face Picture Generation Part

36 Face Center and Inclination Primary Detecting Element

37 Jaw Position Primary Detecting Element

38 Photographic Portrait Generation Part

50 Personal Computer

51 CPU

56 RAM

61 Flexible Disk Drive

62 CD-ROM Drive

63 Hard Disk Drive
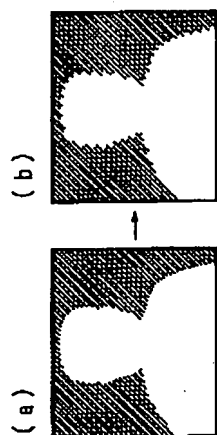
[Drawing 1]

本発明の前景画像抽出及び自動トリミングの手順の概略を
説明するための模式図
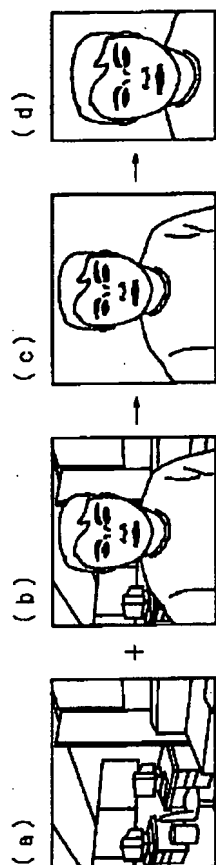
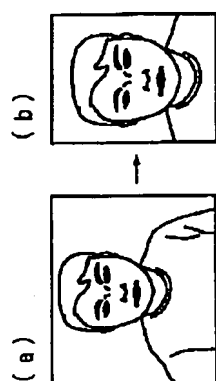[Drawing 2]

本発明の前景画像抽出方法の手順を説明するための模式図
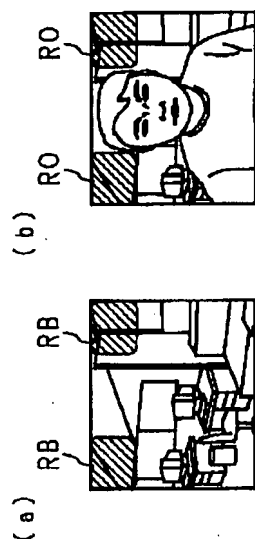
[Drawing 6]
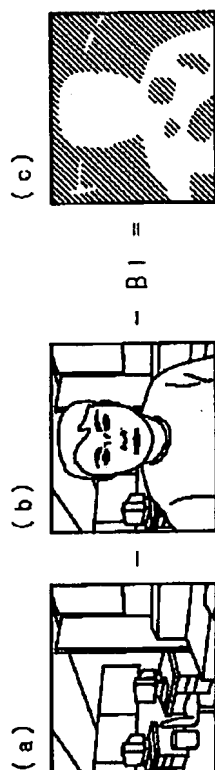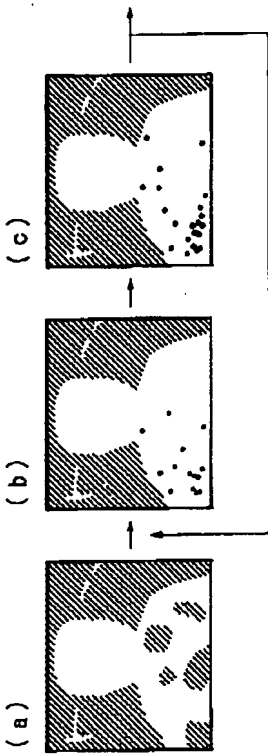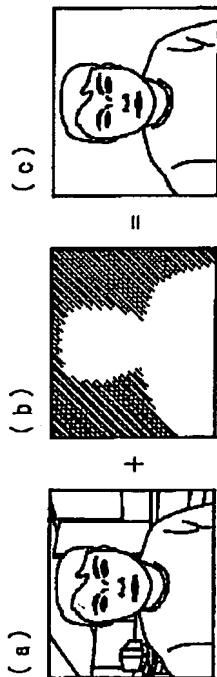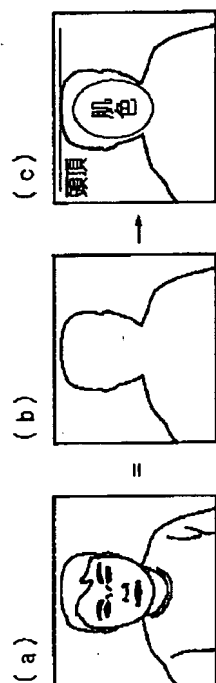本発明の前景画像抽出方法の手順を説明するための模式図

[Drawing 8]

本発明の自動トリミングの手順を説明するための模式図

[Drawing 3]
本発明の前景画像抽出方法の手順を説明するための模式図

[Drawing 4]

本発明の前景画像抽出方法の手順を説明するための模式図

（c）　（b）　（a）

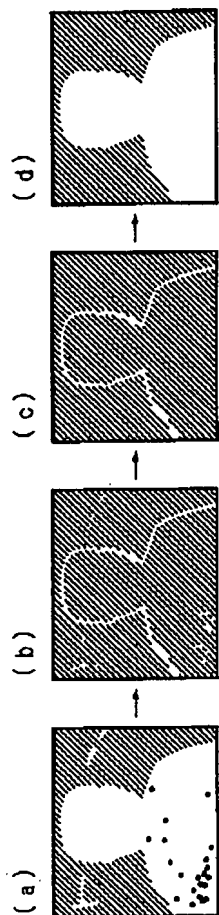[Drawing 7]
本発明の前景画像抽出方法の手順を説明するための模式図

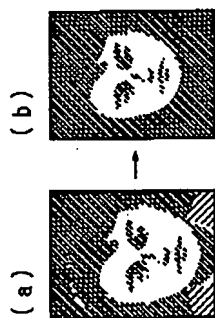（c）　＝　（b）　＋　（a）

[Drawing 9]
本発明の自動トリミングの手順を説明するための模式図

[Drawing 5]
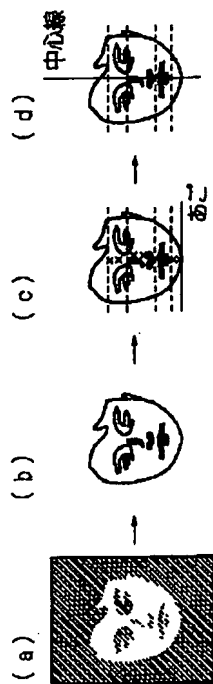
本発明の前景画像抽出方法の手順を説明するための模式図

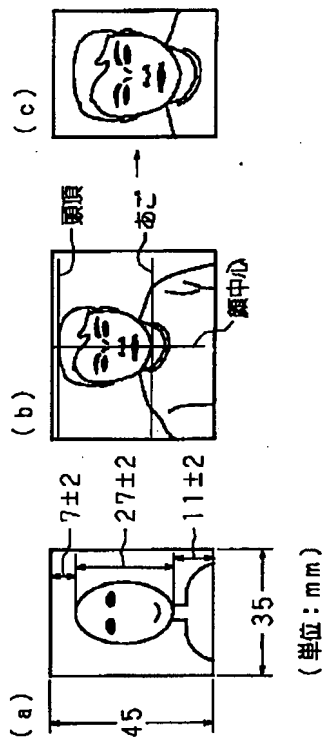

[Drawing 10]

本発明の自動トリミングの手順を説明するための模式図
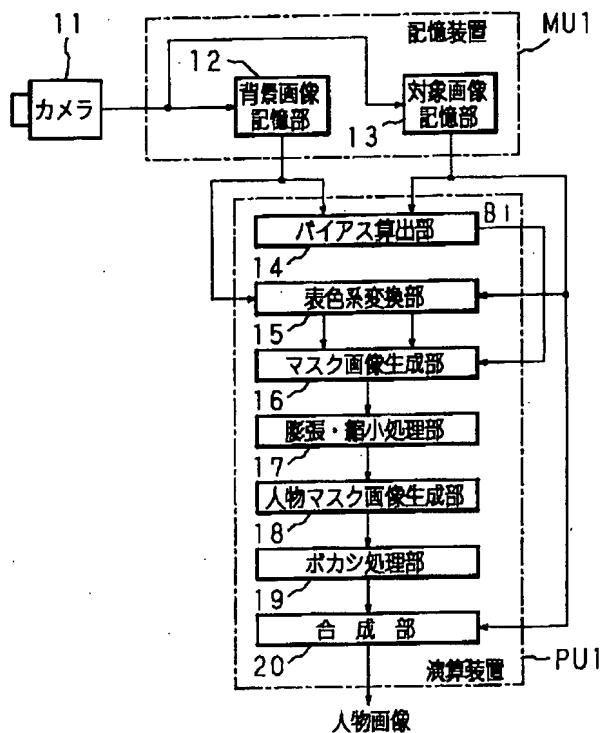

[Drawing 11]

本発明の自動トリミングの手順を説明するための模式図

[Drawing 12]
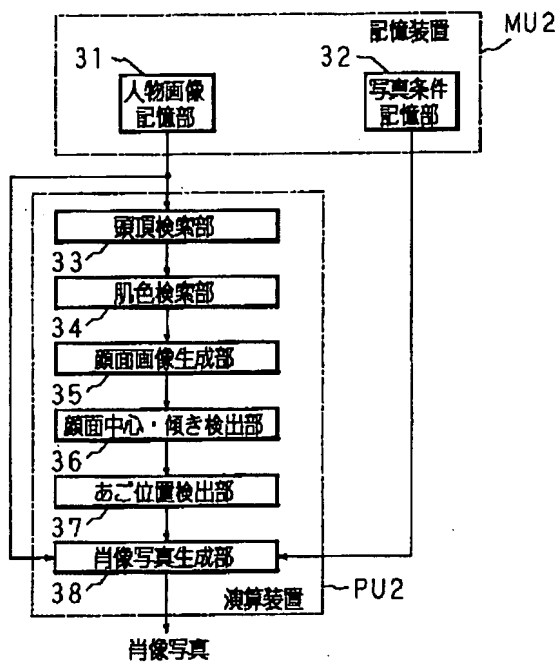
本発明の自動トリミングの手順を説明するための模式図

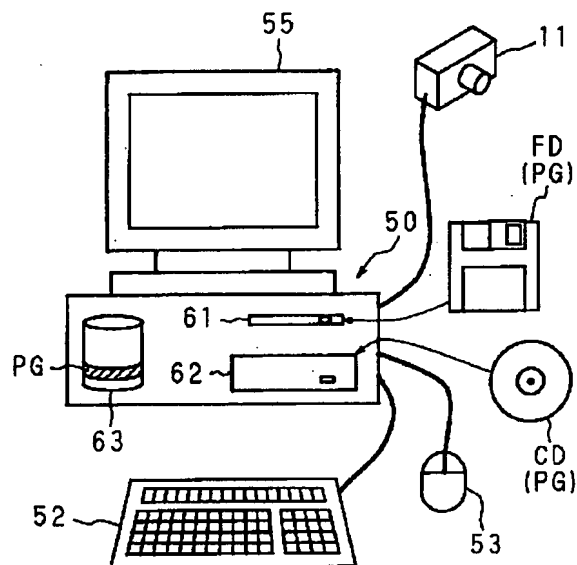[Drawing 13]

本発明の画像処理装置の構成例を示す機能ブロック図

[Drawing 14]

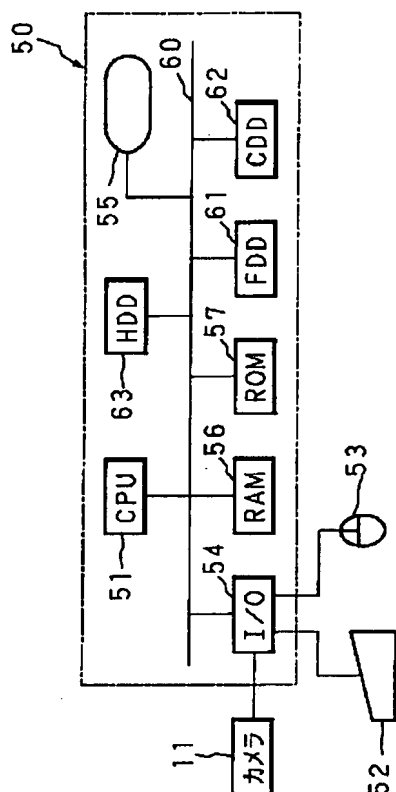本発明の自動トリミング装置の構成例を示す機能ブロック図

[Drawing 15]

本発明の記録媒体がインストールされるパーソナルコンピュータの
外観を示す模式図

[Drawing 16]
本発明の記録媒体がインストールされるパーソナルコンピュータの
内部構成例を示すブロック図

[Drawing 17]

本発明の記録媒体に記録されているコン

ピュータプログラムの内容を示す模式図

FD

PC11：背景画像と対象画像とのバイアス値Biを算出するプログラムコード
PC12：背景画像と対象画像とに同一の表色系変換処理を施すプログラムコード
PC13：表色系変換後の背景画像と対象画像との差分を求め、バイアス値Biを補正してマスク画像を生々するプログラムコード
PC14：マスク画像に対して明るさの膨張・縮小処理を施すプログラムコード
PC15：人物の領域と背景の領域との境界線で領域を分割して人物マスク画像を生成するプログラムコード
PC16：人物マスク画像をボカシ処理するプログラムコード
PC17：人物マスク画像と対象画像とを合成して人物画像を生成するプログラムコード
PC21：人物画像中から人物の頭頂を検索するプログラムコード
PC22：検索された頭頂の下方近傍で肌色を検索するプログラムコード
PC23：検索された肌色の平均値を算出するプログラムコード
PC24：肌色の平均値を中心とする所定範囲の肌色の領域を人物の顔面として顔面画像を生成するプログラムコード
PC25：顔面画像の中心線, その傾きを検出するプログラムコード
PC26：顔面画像からあご位置を検出するプログラムコード
PC27：写真条件に合わせて肖像写真を生成するプログラムコード

[Drawing 18]

本発明の肖像写真装置としてのパーソナルコンピュータの動作手順を
示すフローチャート

```
            ( 開　始 )
  ┌─────────────────────┐
  │ 背景画像及び対象画像の読み込み │ S10
  ├─────────────────────┤
  │ 両画像のバイアス値B Iの算出  │ S11
  ├─────────────────────┤
  │   両画像の表色系の変換    │ S12
  ├─────────────────────┤
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[Translation done.]